

# Feedback from the real life



How science can help when concrete  
does not follow the theory

*François Segrétain – Lafarge France*

# Who I am



- François Segretain Lafarge Béton France
- Expert technical concrete for France
- I manage the amicable or legal disputes
- Specialist for all concrete constructions
- Pathologies for buildings, industrial floors , bridges and all civil engineering work .....

# The problems I addressed with Gilles

I worked many times with Gilles about pathologies regarding

- Cracks
- Curling in concrete slabs
- Water dosages and drying
- Shrinkage

- We often discussed the various pathologies related to construction in general and particularly in the concrete parts of constructions
- I explained to him the problems and the feedbacks we were getting through claims, and what were the most risky products
- ... knowing the difficulties of manufacturing of our products and implementation by construction companies



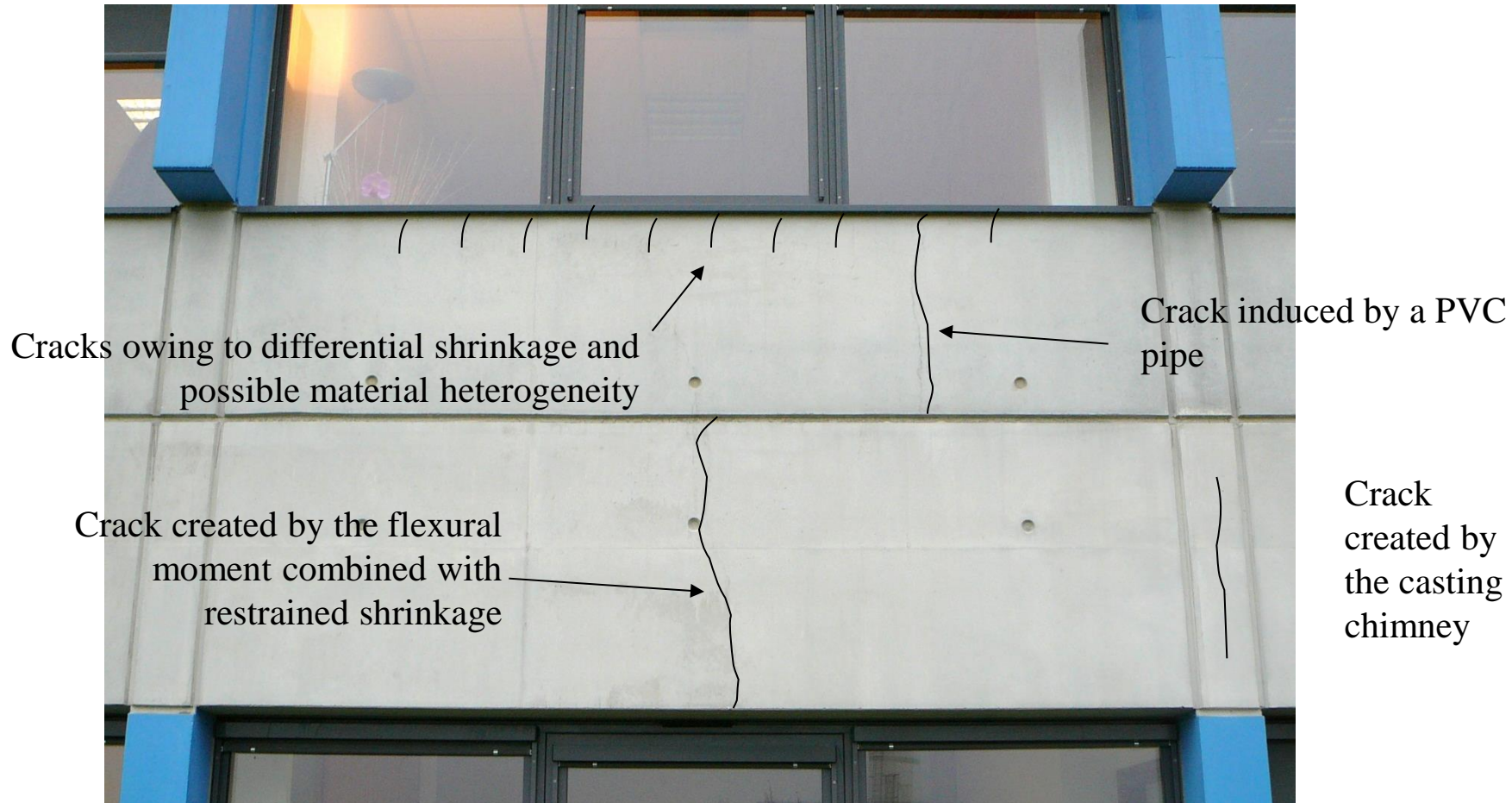
# Various case studies

# Lafarge Bétons in Nantes



- We started in 2003 during the construction of Lafarge Bétons offices in Nantes. Self-compacting concrete walls were instrumented to monitor humidity and temperature
- Then a monitoring of cracking of the walls was conducted

# Lafarge Bétons in Nantes (cont.)



**Conclusion from Gilles (and Bruno): these cracks have a double origine (construction system + material). However, the pretty high shrinkage is an important factor**

# Warping of a slab-on-ground



- 4cm-warping of a 25cm-thick concrete slab
- Gilles: « Warping is then proportional to shrinkage, to the square of the length and inversely proportional to the thickness »
- Gilles: « After discussion with Rémi, we wondered about a possible swelling phenomenon, however this swelling would have been blocked by the shoulders. Therefore I have no convincing explanation. The previous calculation is only a superior bound. I am finally advising magics ! »





# A crack-free building

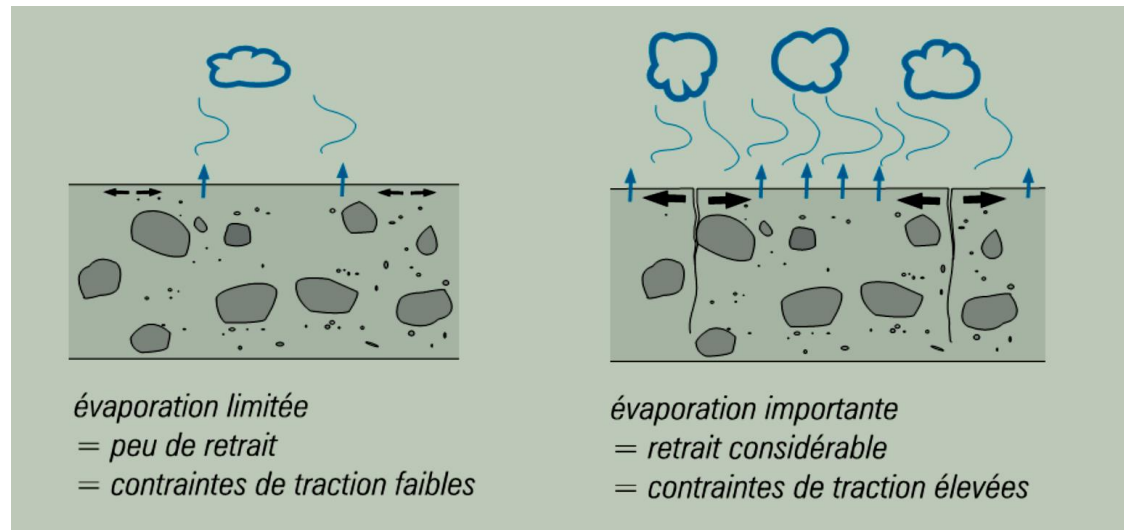
- Study of a crack-free building (Tokyo) 2009
- Gilles: « To build a crack-free building is certainly possible. It takes a good mastery of material/structure interactions + concrete mix-design. As for bubbles, this is an even more complex technological aspect, but we start getting solutions through the ASC project »
- Cracks curve on a slab



# Industrial soil in La Rochelle

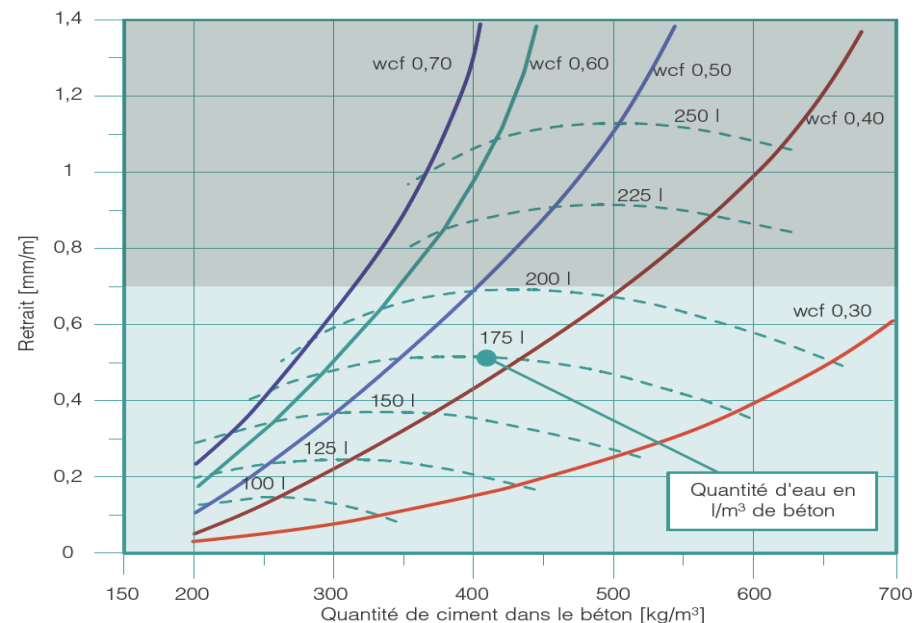


- Concrete crack of industrial soil in La Rochelle
- Gilles: «... hot-weather concreting. Strength losses can come. Have a look on plastic shrinkage nomograms from Québec or from belgian Febelcem very good documents



# Industrial soil in La Rochelle (cont.)

- Differential shrinkage in a grain silo due to changes in water/cement ratio
- Gilles: “ This interesting nomograms gives good order of magnitudes »



## Setting time in-place measurement

- Humm probe to detect concrete setting
- This probe was tested by industrial soils contractors in order to detect the beginning of the setting process
- LCR developed a specific apparatus





# Dusty red concrete soil



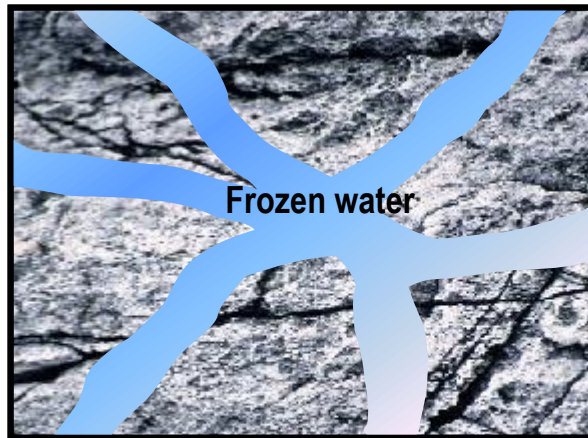
- Dusting of a red concrete school yard: all kids were red and dusty !
- Gilles: « Quick drying without curing compound »



# Explanations on air entrainment

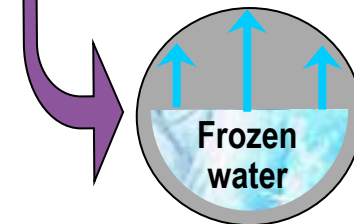
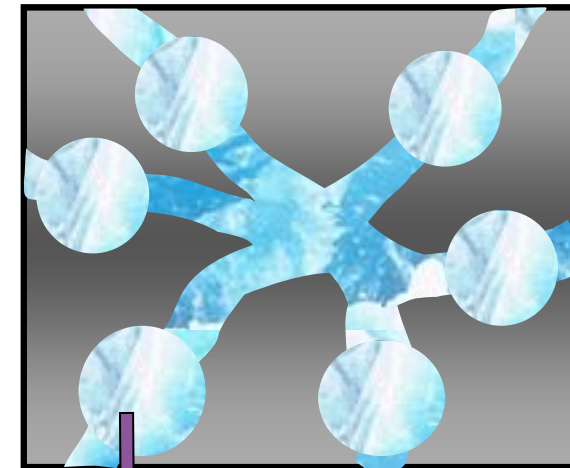
Presentation to the technical staff about the mechanisms of air-entrainment, and the protection given to hardened concrete submitted to freeze-and-thaw

**Without AEA**



The volume of freezing water expands by 9%, creating degradation of concrete

**With AEA**



Entrained air bubbles allowing the free expansion of ice

# Delayed Ettringite Formation

- DEF (Delayed Ettringite Formation) on structures and shrinkage cracks
- LCR meeting with our experts for DEF
- Expertise on various case studies
- + Pathology of industrial floors: cracking, curling, peeling of the top layer

# Gilles' attitude with practitioners



- Gilles had a real passion for concrete, in theory and practice, in the books, in the laboratory and in the real life
- He was committed not to leave a question without any answer
- When I asked him a question, he made it a point of honor to find an explanation with strong references to reports, to publications from different countries or to his own experience







Thank you for your attention !